CURRENT EDUCATIONAL WRITINGS

I. REVIEW OF CURRENT LITERATURE ON GENERAL SCIENCE

The current literature on general science may for the purpose of review be divided into three groups: (*a*) articles and reports of committees dealing specifically with phases of general-science organization and instruction, (*b*) text-books and laboratory manuals, and (*c*) articles pertaining to secondary organization as far as this concerns science organization. Since this is the first of the series of annual reviews to appear in this periodical, there shall be no attempt to limit the review to only that literature which has appeared during the past year. Many excellent articles have appeared previous to 1916, and a complete list, including articles of a more general nature, but related to the general-science problem, will be sent upon request to the writer.

The titles of articles which give direct attention to general science are too numerous to include here. Mr. W. L. Eikenberry has prepared an extensive bibliography of the literature, March, 1917, *General Science Quarterly*. This list will be continued in an early number of the *Quarterly*.

The majority of these articles are found in late volumes of the following periodicals: *School and Society*, *School Science and Mathematics*, *School Review*, and *General Science Quarterly*. The general-science movement has brought out so much discussion, especially in the East, that the *General Science Quarterly* was established as a clearing-house for opinions on the subject. The first number was published in November, 1916. Mr. W. G. Whitman, Salem, Massachusetts, is the editor. The editor is finding no difficulty in getting copy and subscriptions for the journal. *School Science and Mathematics* has recently organized a general-science department with Mr. Fred D. Barber, of Normal, Illinois, as editor. *School Review* and *School and Society* have published several general-science articles which, as a rule, deal with the more general question of the place of general science in the curriculum. A few articles are found in *School World* and inform one that England, too, has been confronted with the reorganization of secondary science and the place of a general course as an introduction to the special sciences.

ARTICLES DEALING SPECIFICALLY WITH GENERAL SCIENCE

The content of these articles may be grouped under several topics. Comment of a general nature will be made upon these, followed by a list of the articles which bear particularly on the topic given.

1. *Arguments for and against general science.*—Fortunately or unfortunately for the reader a large number of the articles are enthusiastic reports of the success of a general-science course. This is in part explained when one notes that the majority are reports of teachers in the field. As far as the writer recalls, but a single teacher among those who have taught first-year science reports a lack of enthusiasm over the results. While the teachers are generally satisfied with general science, no measurement of the results or values of the course are available other than a few statistical investigations of the interest shown by pupils taking the work and of the elections in the subject in various schools.

The arguments for general science most commonly given in these articles are:

a) First-year pupils are too immature for special science courses.

b) Pupils are interested in the course since the subject-matter is drawn from the everyday experiences of the pupils.

c) Units of practical interest to the pupil are more desirable than theoretical or logical units of organization of a mature scientist.

d) With the greater interest of the pupil comes better scientific study, increase of elections, and a higher grade of work in later special sciences.

e) Organization is not dominated by college-entrance requirements.

f) The course is easily adapted to local conditions.

Many of the earlier articles previous to 1916 give similar arguments. The references below cover most of these arguments.

Hanna, *School Science and Mathematics*, 1916, p. 210.
Ruch, *School Science and Mathematics*, 1916, p. 49.
Barber, *School Review*, 1916, p. 426.
Hessler, *School Science and Mathematics*, 1916, p. 407.
Caldwell, *School Review*, 1915, p. 134.
Elhuff, *General Science Quarterly*, 1916, p. 17.

The arguments against general science come chiefly from college and university professors and from high-school teachers of special sciences. Those commonly given are:

a) The course lacks unity; it is a hodge-podge, or worse than that.

b) Good teachers of such a general course are not available.

c) Time spent in reorganization would be better spent in improving teaching of special sciences.

d) General science is a waste of time, since it gives little of fundamental principles of the sciences, no logical development of subject-matter, and little, if any, training in scientific method.

e) Pupils are interested in the special sciences if they are properly taught.

f) General science must crowd out other secondary courses.

Coulter, *School Review*, 1915, p. 1.
Millikan, *School Science and Mathematics*, 1916, p. 193.

One fact is evident from the reading of the articles: general-science courses are being introduced throughout the country. One is forced to believe, if the experiences of the teachers and administrators in the field is a fair criterion, that general science in some form of organization, given in the first year of the present high school or in the first or second year of the junior high school, has come to stay. Further viewpoints on the value of general science will be found in:

Lewis, *School Review*, 1916, p. 426.
Eikenberry, *School Review*, 1915, p. 181.
Rowell, *School Science and Mathematics*, 1911, p. 116.
McAuley, *School Science and Mathematics*, 1911, p. 14.
Taylor, *School Review*, 1916, p. 20.

2. *Aims of general science.*—Among the many aims of a general-science course one commonly finds: (*a*) acquisition of the simple principles of the various sciences; (*b*) usable information about daily experiences; (*c*) development of powers of observation and conservative conclusions; (*d*) training in problem-solving; (*e*) preparation for later sciences and a bird's-eye view of the field to aid the student in his choice of further science study; (*f*) deepening and broadening of pupils' interests; (*g*) prevocational guidance; (*h*) preparation for the life in which the pupil finds himself.

A proper balance of these aims gives the basis for selection of subject-matter. Yet few writers agree on the relative importance of each. This is well demonstrated by the various texts that have appeared. One finds difficulty in predicting what the content of the course will be from the statement of aims in the preface.

Carpenter, *General Science Quarterly*, 1916, p. 46.
"Massachusetts Committee Bulletin," *General Science Quarterly*, 1916, p. 37.
Elhuff, *General Science Quarterly*, 1916, p. 17.
Johnson, *General Science Quarterly*, 1917, p. 83.
Barber, *School Review*, 1916, p. 724.
Caldwell, *School Science and Mathematics*, 1916, p. 393; also *General Science Quarterly*, 1917, p. 1.
Eliot, *Occasional Paper No. 1, General Education Board.*

3. *Organization and content.*—Two important questions are raised by the articles: (*a*) What shall be the length of the course? (*b*) What principles shall govern the organization?

The Biology Subcommittee of the Committee on Reorganization of Secondary Education, appointed in 1913, reports that unity of subject-matter is of most importance; that two years of work in elementary science be required unless administrative difficulties prohibit it; that the content be grouped and presented in the following units: physical environment, plants, animals, and man; and that human welfare is the motive that should underlie all elementary science instruction. At the 1916 meeting of the National Education Association the same scheme was reported by the committee. Serious objections by

various speakers to the "vertical stratification" into special sciences followed the report.

Barber presents a somewhat different scheme showing how general science should be related to the home, street, and school, and then be expanded in the second year to plant and animal life about school, personal hygiene, and community sanitation.

Preliminary Report, Biology Subcommittee, *School Science and Mathematics*, 1915, p. 44.

Report by Biology Subcommittee, *Proceedings of the National Education Association*, 1916.

Barber, *School Review*, 1916, p. 724; also *General Science Quarterly*, 1917.

Coulter, J. G., *School and Society*, 1915, p. 226.

Whitney, University of Illinois High-School Conference, 1916.

In different schools practically every special science has been made the core of the first-year work. Thus we find biology and geography given as the organizing subject or general-science courses as a basis for geography, agriculture, and other special sciences. Some writers believe that physics and chemistry are fundamental to all science study. Others argue for topical units of organization without regard to the place given the content by the special sciences.

Hanna, *School Science and Mathematics*, 1916, p. 210.

Robinson, *School Science and Mathematics*, 1915, p. 717.

Hessler, *School Science and Mathematics*, 1916, p. 407.

Caldwell, *School Review*, 1916, p. 134.

Various courses not found in the textbooks given later have been organized.

Austin, *School Science and Mathematics*, 1911, p. 217.

Welch, *National Education Association Proceedings*, 1915, p. 1022.

Carpenter, *General Science Quarterly*, 1916, p. 46 (the organization and aims of the general-science course in the Rochester ([N.Y.] Junior High School).

Johnson, *General Science Quarterly*, 1916 (general science for eighth grade).

4. *Method.*—There is found in the literature much discussion of the method of teaching first-year science. The project plan; the emphasis of laboratory, demonstration, and textbook; the use of supplementary reading material; field work, are topics for argument. Several good references are listed.

Dewey, *General Science Quarterly*, 1916, p. 3; also *National Education Association Proceedings*, 1916.

Von Hofe, *School Science and Mathematics*, 1915, p. 751.

Webb, *School Science and Mathematics*, 1915, p. 679.

Hessler, *School Science and Mathematics*, 1916, p. 518.

Kilpatrick, *General Science Quarterly*, 1917, p. 67.

5. *Sequence.*—Several studies showing the position of general science and the basis for sequence which it affords are worthy of consideration. Among these are studies by Downing, Taylor, Barber, Lewis. With general science in the first year, biology comes most often in the second, physics in the third,

and chemistry in the fourth. Whitney has, it seems to the writer, summed up the reasons for our present sequence, if there are any, and has also stated well the factors which should govern the sequence. Since his statements do summarize the views, they may be given briefly. The factors determining the present sequence are (*a*) expediency, (*b*) size of classes, (*c*) cost of apparatus, (*d*) college-entrance requirements. The factors which should determine the organization and sequence are (*a*) needs and interests of the pupils, (*b*) development of the pupil and character of the locality, (*c*) early courses should prepare the pupil in the principles of the sciences, (*d*) applied science should follow preparatory courses, (*e*) half-year courses should be omitted.

Whitney, University of Illinois High-School Conference Proceedings.
Snedden, *School and Society*, 1915, p. 436.
Flexner, *Occasional Paper 3, General Education Board.*
Hanna, *School Science and Mathematics*, 1916, p. 210.
Coulter, J. G., *School Science and Mathematics*, 1916, p. 303.
Barber, *School Review*, 1916, p. 724.
Downing, *School Review*, 1915, p. 272.
Taylor, *School Review*, 1916, p. 20.
Lewis, *School Review*, 1916, p. 426.

TEXTBOOKS AND LABORATORY MANUALS[1]

Probably the textbooks and laboratory manuals which have appeared to date are the best evidence of the present status of general science as regards the ideas of organization, method, and aims of the course. Here, again, widely differentiated views are exposed.

There have appeared to date ten textbooks. One laboratory course not accompanied by a text is included in the list below. Each of the other texts except one is accompanied by a manual of laboratory directions.

Clark, *General Science.* American Book Co., 1910.
Rowell, *Introduction to General Science.* Macmillan, 1911.
Caldwell and Eikenberry, *Elements of General Science.* Ginn, 1914.
Snyder, *First Year Science.* Allyn & Bacon, 1914.
Hessler, *The First Year of Science.* Sanborn, 1914.
Clark, *An Introduction to Science.*
Pease, *A First Year Course in General Science.* Bobbs-Merrill, 1915.
Elhuff, *General Science*, Heath, 1916.
Weckel and Thalman, *A Year in Science.* Row, Peterson, 1916.
Brownell, *Laboratory Lessons in General Science.* Macmillan, 1916.
Barber, *First Course in General Science.* Holt, 1916.

General Science by Miss Clark represents a course not intended to prepare for college-entrance examinations, but a course which will prepare the reader

[1] The paragraph following the title of each textbook gives in essence the purpose of the course as expressed in the preface of the book.

to meet life's important problems and to pass muster on the principles and theories underlying scientific and economic management in the shop or in the home. The *Laboratory Manual in General Science* gives directions for experiments designed to make the pupil familiar with the facts and theories discussed in the textbook.

Introduction to General Science by Rowell is written to interest the pupil in immediate needs and his close surroundings and to lead him to arouse himself to the habit of seeking for a cause and of looking beyond the present and immediate to the future and ultimate. It further aims to give the pupil a bird's-eye view of all sciences, the power to see the interrelation of all sciences, and to reason from many points of view. Another value lies in awakening the mind to the possibilities of scientific knowledge and mental attainments and stimulating the ambition to learn more about at least one science. The course is elastic and local conditions can be emphasized.

Elements of General Science by Caldwell and Eikenberry proposes to give a usable fund of knowledge about common things, a more scientific attitude in interpreting problems, to make more effective and profitable the later work in the differentiated sciences. No attempt is made to maintain the unity of any one of the different sciences from which material is taken. Rather unity is secured by means of the logical connections between topics. The topics are of general significance.

First Year Science by Snyder deals with the earth and the sun in their relations to man. This treatment gives three advantages: (*a*) unity, (*b*) practical interest, (*c*) preparation for college-entrance examinations (in physiography). The language is simple, and the principles are thoroughly illustrated by experiment. All secondary sciences are treated so that the pupil may find his particular interest. The book is complete; no reference or manual is needed.

The First Year of Science by Hessler is written to meet the need of general-science instruction. The most important part of the course is the acquisition of the introductory notions of physical and chemical phenomena, but it includes also the problems of modern conveniences, the soil, plants and animals, and sanitation. The text is an answer to the question: Can general science be given in large first-year classes with varied needs, without specially prepared teachers and without expensive equipment?

An Introduction to Science by Miss Clark aims to start pupils on projects which will influence for good their present and future lives.

A First Year Course in General Science by Miss Pease offers an introduction to special secondary sciences. For those who do not finish high school it gives a comprehensive view of science. The world in which the student is a part furnishes the material for the course. This begins with the earth, the forces acting upon the earth, and the composition of matter. Physiographical material follows, and then life on the earth completes the view. The laboratory exercises are designed (*a*) to fix the principles and facts, (*b*) to teach by experiment one or more applications of the principle, (*c*) to accustom pupils to follow directions

and record accurately observations, (*d*) to teach pupils to draw reasonable conclusions.

General Science by Elhuff is intended to offer a scientific explanation for the many experiences of pupils and to create a desire for further knowledge. It meets the demand for both full-year and half-year courses, and presents the fundamental principles of science and of scientific study in such a way that pupils will acquire the desire to study the special sciences. For half-year courses the first twenty-four chapters are to be followed. The basic ideas in the course are matter, its properties and reaction of matter upon matter, and energy.

A Year in Science by Weckel and Thalman is an effort to present subject-matter of interest to the pupil, adapted to his stage of mental development, and of educative value. It provides a groundwork for the special sciences and has stood the test of time. Fifteen years of experimentation have established the course. Information for appreciation of environment and scientific thinking train the pupil to become a better citizen of the community.

Laboratory Lessons in General Science by Brownell brings together from scattered sources that which would appeal to beginners and which would find unity in their experiences and interests. The emphasis in these lessons is placed upon the personal and community aspects of the pupil's interests. This makes necessary and desirable topics of social science. Differentiation of the various sciences is not found in the lessons.

First Course in General Science by Barber is not written primarily to survey the whole field of science and present scattered bits from every special science. Nor is the course primarily intended for preparation to later science study. The primary function of the course is to give a rational, orderly, scientific understanding of the pupil's environment. The train of thought in the organization is guided by two parallel rails, the one physical—*energy*—and the other, sociological, *human welfare*.

These textbooks are discussed as to choice of material and organization in several articles and book reviews. Lewis, *School Review*, 1916, p. 426, shows the distribution of material in several texts. Webb, *School Science and Mathematics*, June, 1917, gives a statistical study of the ten texts. The current number, May, 1917, of the *General Science Quarterly* contains a review of each of the texts.

ARTICLES AND PAPERS RELATED TO THE GENERAL-SCIENCE SITUATION

In the 1915 and 1916 reports of the Commissioner of Education one reads that the junior high-school movement is making rapid progress. This movement concerns the science reorganization. The student of the general-science problem will be interested in the literature listed below.

Judd, "The Junior High School," *School Review*, 1916, p. 249.

Weet, "A Junior High School," *School Review*, 1916, p. 142.

The Detroit Junior High-School Course of Study.

Carpenter, "General Science in the Junior High School (Rochester)," *General Science Quarterly*, 1916.

Several other articles or papers with which the reader interested in general science and its future should be familiar are:

Flexner, "The Modern School," *Occasional Paper No. 3, General Education Board.*

Eliot, "Changing Aspects in Secondary Education," *Occasional Paper, No. 1, General Education Board.*

Snedden, "New Problems in Secondary Education," *School Review*, 1916, p. 177.

Snedden, "Principles of Aim, Organization," *School and Society*, 1915, p. 346.

Orr, *Massachusetts Board of Education Report*, 1914–15.

Briggs, "General Science in Secondary Schools," *Teachers College Record*, 1916, p. 19.

II. BOOKNOTES AND REVIEWS

WILKINSON, W. A. *Rural School Management.* Boston: Silver, Burdett & Co., 1917.

This is the first volume of the "Teacher Training Series," being put forth under the editorship of Dean Charters, of the Faculty of Education, University of Missouri. The editor points out that the majority of texts for teachers stress principles rather than methods and assume that the young teacher will commence work in the city graded school. The new series is planned to meet the need of the teacher already in service and of the inexperienced teacher, more particularly in the one- and two-room school of rural districts and smaller villages.

With respect to subject-matter, this book is not composed of the same old materials simply rearranged, repolished, and retitled. Since human nature is in the main largely identical in town and country, and fundamental knowledge cannot be changed in any large way, the subject-matter treated is, in part, necessarily similar to that found in many of the older professional books. Fundamental knowledge, however, has become a hydra-headed creature. Instruction in every item is neither possible nor necessary, for time is pressing, and that which is fundamental in one locality is foreign to the needs of another. The teacher, even though inexperienced, must choose. How frequently in the past this choice has been thoughtless or, at best, has been under the guidance in the main of tradition! Here is made a noteworthy contribution toward assisting all rural-school teachers to recognize two large facts and to conduct their activities, whether within or without the school premises, in accordance with these facts. There is never lost the point of view that the boys and girls of the schools in question are country boys and girls, and that they have bodies and minds and habits, for the efficient development of which the school as an institution and the teacher as its presiding officer have been made responsible. The other underlying current treats of the power which the school may and should exercise in improving the social and economic status of the community.